

Comprehensive Examinations Program Results

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INTRODUCTION

This is a summary report of the results attained by high school students on the comprehensive examinations administered in January 1983 as part of the Student Evaluation Program conducted by Alberta Education. In addition to reporting the average performance for the discipline areas as a whole, the report provides a profile of sub-test scores within each area.

The report is designed to highlight each examination and the pertinent results. Each examination is discussed briefly and the results reported include the number of candidates, mean score, standard deviation, proportion of passes (i.e., scores of 50%+), and the frequency of distribution of the total scores. As well, accompanying each set of results is a brief comment about the overall results attained on each comprehensive examination. The report concludes with an outline of the scoring procedures.

THE COMPREHENSIVE EXAMINATIONS PROGRAM

The purpose of the Comprehensive Examinations Program is to certify the degree of academic achievement attained by well-motivated and achieving students graduating from high school.

Examinations are offered in four major discipline areas: language arts, history and the social sciences, mathematics, and the physical and biological sciences. Alberta Education administers the examinations twice yearly, in January and in June. Each comprehensive examination is reviewed and approved by a Technical Review Committee (TRC) having representation from the Alberta Teachers' Association, the Conference of Alberta School Superintendents, the Council of Presidents of Public Colleges, the Universities Coordinating Council, and the Program Development, Program Delivery, and Planning and Evaluation Divisions of Alberta Education.

Students writing the comprehensive examinations receive a statement of results showing for each examination, a total percentage score indicating overall performance and a profile of achievement for specific content areas examined. As a matter of current policy, the individual student results are released only at the request of the student, and will appear on a document distinct from the high school transcript. Unless the student indicates otherwise, these results will be reported to the superintendent of schools of the jurisdiction in which the student is registered.

OVERALL RESULTS

The 1982-83 Comprehensive Examinations Program is directed at those students achieving marks of 65 per cent or better in related 30-level subjects in high school. Given the nature of the students who chose to write the examination in January and their low numbers, the overall results attained by this group of students do not permit generalization to the Grade 12 population. In the interpretation of the results, it is proper to generalize performance adequacy, strengths, or weaknesses only to the group that wrote any one examination. An additional caution in interpreting the results is that all assessments of student performance are subject to a statistical error

of measurement. While every effort has been made to minimize such error, the results should be regarded as estimates of individual student achievement at the high school level. Hence, the results presented in this report provide an indication only of the performance of a self-selected group of Alberta high school students on a challenging set of external examinations.

Considering it is only proper to restrict interpretations to the group of students that wrote a particular examination, there is some risk in making any generalization. Notwithstanding the risk, the main observation regarding student performance on the comprehensive examinations administered in January 1983 is that the overall quality of response to the written expression sections and to the short-answer open-ended questions indicates somewhat shallow and superficial effort at the expense of reasoned and disciplined thought.

The following two tables present a summary of the overall results of the comprehensive examinations administered in January 1983 and a profile of average student scores in the various aspects of each examination.

SUMMARY OF COMPREHENSIVE EXAMINATIONS RESULTS - January 1983

<u>Examination</u>	<u>Examination Candidates</u> ¹	<u>Expected Mean (%)</u> ²	<u>Actual Mean (%)</u> ³	<u>Standard Deviation</u>	<u>Percentage of Passes</u> ⁴
LANGUAGE ARTS	620	55	59.4	12.4	84
HISTORY AND THE SOCIAL SCIENCES	445	55	58.7	13.4	79
MATHEMATICS	530	55	45.9	16.5	41
PHYSICAL AND BIOLOGICAL SCIENCES					
Biology	348	55	51.7	14.0	58
Chemistry	411	55	52.9	15.2	60
Physics	168	55	50.9	11.3	55

NOTES:

1. An examination candidate is deemed to be a student who completes a comprehensive examination.
2. The expected mean reflects the design estimate of achievement on the examination as determined by pre-testing techniques and the apparent level of difficulty as judged by the appropriate Technical Review Committee.
3. The actual mean is the average score attained by the examination candidates.
4. The percentage of passes indicates the proportion of examination candidates who achieved a score of 50 per cent or better. Values have been rounded to the nearest whole per cent.

PROFILE OF COMPREHENSIVE EXAMINATION RESULTS - January 1983

LANGUAGE ARTS	Average Student Score (%) *	Possible Score (%) *
1 Understanding & analysis of meaning	29	44
2 Understanding & analysis of techniques	9	16
3 Literary essay	10	20
4 Expressive writing	11	20
TOTAL LANGUAGE ARTS	59%	100%

HISTORY & SOCIAL SCIENCES	Average Student Score (%)	Possible Score (%)
1 Organizing principles & concepts	22	35
2 Skills & competencies	22	35
3 Written response (essay)	15	30
TOTAL HISTORY & SOCIAL SCIENCES	59%	100%

MATHEMATICS	Average Student Score (%)	Possible Score (%)
1 Mathematical systems & equation-solving	14	28
2 Functions & relations	11	27
3 Geometry, trigonometry, sequences, series, & limits	21	45
TOTAL MATHEMATICS	46%	100%

BIOLOGY	Average Student Score (%)	Possible Score (%)
1 General Science	17	25
2 Classifications, kingdoms & cells	3	7
3 Environmental biology & genetics	11	23
4 Physical properties of cells, nutrition, & functions	21	45
TOTAL BIOLOGY	52%	100%

CHEMISTRY	Average Student Score (%)	Possible Score (%)
1 General Science	18	25
2 Stoichiometry, solutions, bonding & organic chemistry	13	21
3 Chemical energetics, acid-base theory, & oxidation-reduction	22	54
TOTAL CHEMISTRY	53%	100%

PHYSICS	Average Student Score (%)	Possible Score (%)
1 General Science	18	25
2 Mass, force, motion, momentum, energy & waves	13	24
3 Light, electricity, magnetism, matter & energy	20	51
TOTAL PHYSICS	51%	100%

* Values have been rounded to the nearest whole per cent.

THE LANGUAGE ARTS COMPREHENSIVE EXAMINATION

The Language Arts Comprehensive Examination consists of two equally weighted parts: Part A - Literature and Part B - Communications. In each part, multiple-choice items contribute 22 per cent, short-answer items contribute 8 per cent, and the extended writing assignment contributes 20 per cent of the total possible score. The results of Parts A and B are combined to produce the four scores indicated in the profile: understanding and analysis of meaning and of technique, literary essay, and expressive writing.

PART A - LITERATURE requires thoughtful and sensitive reading of poems, plays, short stories, and essays. The items focus on human values and their relationships to life; meaning and implications of statements; significance of figurative devices and techniques; and critical response to form, structure, and style. The writing of an essay or a critical response to a literary topic is a further requirement of Part A - Literature.

PART B - COMMUNICATIONS requires purposeful reading of reports, articles, correspondence, advertisements, maps, and cartoons. The items focus on purpose; relevancy of ideas; appropriateness of information; meanings and implications of statements and context clues; and relationships of form, ideas, and purpose. The writing of a report, a letter, or a personal essay is a further requirement of Part B - Communications.

RESULTS

Candidates - 620 Mean Score - 59.4% Standard Deviation - 12.4
Proportion of Passes (Score of 50%+) - 84%

The overall student performance on the language arts examination was satisfactory. Students did better on the multiple-choice section than on the short answer and extended writing sections, and better on the items dealing with meanings than on the items dealing with techniques, structures, and forms. The level of performance was higher for the expressive writing assignment than for the literary essay. Twenty-two students attempted the literary essay but not the expressive writing assignment; 11 students attempted the expressive writing assignment but not the literary essay; 11 students attempted neither writing assignment.

Frequency Distribution of Total Language Arts Scores

Score range	<u>0-39</u>	<u>40-49</u>	<u>50-64</u>	<u>65-79</u>	<u>80-100</u>
Number of students	36	66	247	242	29
%age of students writing	5.8	10.6	39.8	39.0	4.7

THE HISTORY AND THE SOCIAL SCIENCES COMPREHENSIVE EXAMINATION

The History and the Social Sciences Comprehensive Examination is based on the organizing principles and concepts reflected in the high school social studies curriculum. The objectives of the curriculum are elaborated and specified in the *History and Social Sciences Curriculum Specifications for Comprehensive Examinations, Revised 1982*.

The examination is composed of three parts: organizing principles and concepts, skills and competencies, and written response (essay). The first two parts are assessed using machine-scorable multiple-choice items. In these two parts the emphasis on Social Studies 10, 20, and 30 is 20 per cent, 30 per cent, and 50 per cent respectively. Organizing principles and concepts include basic knowledge and understandings from history, geography, political science, economics, philosophy, sociology, and anthropology. Skills and competencies include the inquiry skills of identifying issues, formulating research questions, and organizing, synthesizing, and evaluating data.

The written-response portion of the examination requires the application of inquiry skills in composing a single essay. Students respond to one of two issues relating to the two major topics in Social Studies 30: Political and Economic Systems and Co-operation and Conflict Among States.

RESULTS

Candidates - 445	Mean Score - 58.7%	Standard Deviation - 13.4
Proportion of Passes (Score of 50%+) - 79%		

Given the anticipated level of difficulty of the examination, the overall student performance was satisfactory. Students tended to do better on the multiple-choice section than on the essay. Only nine students did not complete the essay question.

Frequency Distribution of Total History and Social Sciences Scores

Score range	<u>0-39</u>	<u>40-49</u>	<u>50-64</u>	<u>65-79</u>	<u>80-100</u>
Number of students	33	62	176	42	32
%age of students writing	7.4	13.9	39.6	31.9	7.2

THE MATHEMATICS COMPREHENSIVE EXAMINATION

The Mathematics Comprehensive Examination measures student understanding of the concepts introduced in the senior high school mathematics curriculum and the levels of skills achieved. The emphasis that the content from each grade level receives is as follows: Grade 10 - 20 per cent; Grade 11 - 30 per cent; and Grade 12 - 50 per cent.

The 1983 examination is based on the content common to the Mathematics Program (1978) and the core of the new Mathematics Program (mandatory for Grades 10 and 11; optional for Grade 12, September, 1982). The content of the Mathematics 13-23-33 program is included to the extent that it has common elements with the Mathematics 10-20-30 program.

The examination consists of both machine-scorable items (70 per cent) and written-response items (30 per cent). The items measure knowledge of fundamental concepts, skills in using operations and algorithms, and the understanding and application of mathematical principles in three content domains: mathematical systems and equation-solving; functions and relations; and geometry, trigonometry, sequences, series, and limits.

RESULTS

Candidates - 530 Mean Score - 45.9% Standard Deviation - 16.5
Proportion of Passes (Score of 50%+) - 41%

The mathematics examination yielded somewhat lower scores than expected. While there were no unexpected patterns to the data by topic or grade level, the open-ended short-answer questions were not well answered; the proportion of students who did not attempt to solve the 11 problems ranged from 7 per cent to 54 per cent. It would appear that low student motivation may have been a factor; relatively simple problems were not well answered, or, in some cases, not even attempted.

Frequency Distribution of Total Mathematics Scores

Score range	<u>0-39</u>	<u>40-49</u>	<u>50-64</u>	<u>65-79</u>	<u>80-100</u>
Number of students	178	134	122	72	24
%age of students writing	33.6	25.3	23.0	13.6	4.5

THE PHYSICAL AND BIOLOGICAL SCIENCES COMPREHENSIVE EXAMINATIONS

The Physical and Biological Sciences Comprehensive Examination consists of two parts: Part A, the compulsory general science portion, and Part B, biology, chemistry, or physics. Students may write one or more examinations in Part B.

PART A - GENERAL SCIENCE

Part A of the examination measures understanding of general science content and the ability to use this understanding in new situations. Concepts examined include principles of classification; cell theory and organization; chemical and physical change; force and motion; mass; and atomic structure. Examination questions also focus on the ability to apply and understand the scientific processes of predicting, hypothesizing, controlling variables, classifying, interpreting data, observing, designing, inferring, and defining in operational terms. This part is composed of 35 machine-scorable questions, and counts as 25 per cent of the student's total score in the Physical and Biological Sciences Comprehensive Examination.

PART B - BIOLOGY, CHEMISTRY, AND PHYSICS

The biology, chemistry, and physics examinations in Part B focus on the ability to analyze relationships between sets of information, to formulate ideas based on the scientific knowledge possessed, and to judge the value of ideas presented. Students are asked to apply knowledge and scientific process skills to new situations. Each examination is composed of both machine-scorable (60 per cent) and written-response (40 per cent) questions.

Within each of the biology, chemistry, and physics examinations, the scientific processes of predicting, hypothesizing, controlling variables, classifying, interpreting data, observing, inferring, designing, and defining in operational terms are examined in conjunction with the concepts examined.

The written-response questions in each of the biology, chemistry, and physics examinations emphasize the skills of

1. constructing and testing predictions
2. identifying variables in an experimental situation
3. defending predictions with logical arguments
4. identifying a problem from a set of observations
5. stating the assumptions underlying a problem
6. revising hypotheses on the basis of observations
7. designing an experiment
8. making judgments concerning the validity of an explanation for a set of data
9. identifying the shortcomings in an experimental design
10. solving problems requiring the synthesis of information

Students are expected to express their responses in complete sentence form and use annotated sketches and diagrams where appropriate.

BIOLOGY

Concepts examined include classification, biological kingdoms, and cell biology (Biology 10); environmental biology and genetics (Biology 20); and physical properties of cells, nutrition, circulation, gas exchange, cellular respiration, excretion, metabolic controls, and human reproduction (Biology 30).

CHEMISTRY

Concepts examined include stoichiometry (Chemistry 10); solution chemistry, bonding, and organic chemistry (Chemistry 20); and chemical energetics, acid-base theory, and oxidation-reduction (Chemistry 30).

PHYSICS

Concepts examined include mass, force, and motion (Physics 10); momentum, energy, and waves (Physics 20); and light, electricity, magnetism, electromagnetic theory, atomic theory, and modern theories (Physics 30).

The relative distribution of questions across the grade levels in each of the examinations is as follows: Grade 10 - 20 per cent; Grade 11 - 30 per cent; and Grade 12 - 50 per cent.

RESULTS

BIOLOGY

Candidates - 348	Mean Score - 51.7%	Standard Deviation - 14.0
Proportion of Passes (Score of 50%+) - 58%		

The overall performance of the group was lower than expected. The open-ended questions requiring the application of higher levels of understanding and insight were not handled well.

Frequency Distribution of Total Biology Scores

Score range	<u>0-39</u>	<u>40-49</u>	<u>50-64</u>	<u>65-79</u>	<u>80-100</u>
Number of students	51	97	118	71	11
%age of students writing	14.7	27.9	33.9	20.4	3.2

CHEMISTRY

Candidates - 411 Mean Score - 52.9% Standard Deviation - 15.2
Proportion of Passes (Score of 50%+) - 60%

The overall performance on the chemistry examination was close to the expected level. Student performance was better on the multiple-choice items than on the open-ended questions. These questions were more difficult than anticipated, and many students made no attempt to respond or earned no marks for their responses.

The five open-ended questions related to laboratory processes and skills at the Grade 12 level. The data indicate that students had difficulty with both the content and the response mode; poor responses to these open-ended questions influenced the scores.

Frequency Distribution of Total Chemistry Scores

Score range	<u>0-39</u>	<u>40-49</u>	<u>50-64</u>	<u>65-79</u>	<u>80-100</u>
Number of students	71	95	134	81	30
%age of students writing	17.3	23.1	32.6	19.7	7.3

PHYSICS

Candidates - 168 Mean Score - 50.9% Standard Deviation - 11.3
Proportion of Passes (Score of 50%+) - 55%

The scores in this examination were not as high as expected. The open-ended questions that required a full understanding of the concepts of physics were not answered well. For example, exercises requiring students to manipulate two variables at a time were found to be very difficult.

Frequency Distribution of Total Physics Scores

Score range	<u>0-39</u>	<u>40-49</u>	<u>50-64</u>	<u>65-79</u>	<u>80-100</u>
Number of students	19	56	65	26	2
%age of students writing	11.3	33.3	38.7	15.5	1.2

SCORING OF THE EXAMINATIONS

MULTIPLE-CHOICE ITEMS

Responses to multiple-choice items are scanned by machine.

SHORT-ANSWER ITEMS

All short-answer items are scored by trained examiners using a scoring key.

SCORING OF WRITTEN EXPRESSION: LANGUAGE ARTS

Each extended writing assignment is scored independently by three markers. The markers use scoring guides to assess levels of performance on the following aspects:

- a. Thought and Detail - presentation of ideas with purpose and with supporting details
- b. Organization - the shaping of expression into an ordered, coherent, and emphatic unit
- c. Matters of Choice - the selection and use of structures and techniques appropriate to purpose
- d. Matters of Convention - adherence to conventions to maintain accuracy, to enhance expression, and to facilitate communication

Each aspect is scored on a five-point scale: 5 - Exceptional; 4 - Proficient; 3 - Satisfactory; 2 - Limited; 1 - Poor. A mark of 0 is awarded to papers where the attempt is considered to be insufficient. Scores awarded for the aspects comprise 50 per cent of the score for the paper.

Total Expression Scores contribute the other half of the mark. The guide used to score Total Expression for the expressive writing assignment follows:

- 5 EXCEPTIONAL writing presents carefully chosen and closely related supporting thoughts and details that develop a central idea or theme. The content is organized in such a way that the writer's interpretation, attitude, and purpose are unquestionably evident throughout the work. The expression reveals a mature use of language structures, spelling, and vocabulary. Such writing demands respect.
- 4 PROFICIENT writing presents appropriate supporting thoughts and details that develop a central idea or theme. The content is organized in such a way that the writer's interpretation, attitude, and purpose are clearly seen. The expression reveals mastery of language structures, spelling, and vocabulary. Such writing prompts attention.

- 3 SATISFACTORY writing presents conventional thoughts and details that develop a central idea or theme. The content is organized in such a way that the writer's interpretation, attitude, and purpose are generally clear. The expression reveals an awareness of and attention to language structures, spelling, and vocabulary. Such writing is usually accepted as adequate.
- 2 LIMITED writing presents casual thoughts and details that suggest but only partially develop a central idea or theme. The content is organized in such a way that the writer's interpretation, attitude, and purpose are generally unclear. The expression reveals a lack of assurance in language structures, spelling, and vocabulary. Such writing communicates without satisfying the reader.
- 1 POOR writing lacks a central idea or purpose. Detail is non-supportive or non-existent. Content is organized in such a way that the writer's interpretation, attitude, and purpose are not clear. The expression reveals faults in language structures, spelling, and vocabulary that impede communication. Such writing frustrates the reader.
- 0 INSUFFICIENT writing shows that the assignment has not been attempted, that the attempt is of insufficient length, or that the attempt is completely off topic.

HISTORY AND THE SOCIAL SCIENCES

The essay is scored independently by three examiners using scoring guides that address specific topics through definition of categories of acceptable and unacceptable responses with reference to the following aspects:

- a. Statement of Issue
- b. Selection and Application of Knowledge
- c. Alternatives and Defence
- d. Quality of Language and Expression

Each aspect is scored according to a scale that generally incorporates the following values, descriptors, and criteria:

- 5 EXCEPTIONAL responses are characterized by precision, comprehensiveness, mature understanding, and mature presentation of the main issue.
- 4 PROFICIENT responses indicate near mastery in issue assessment and clarity of presentation.
- 3 SATISFACTORY responses reveal general awareness and understanding of the issue and adequacy of attention to presentation.
- 2 LIMITED responses show a degree of uncertainty and vagueness in understanding the issue and a lack of assurance in presentation.

- 1 POOR responses are disorganized and error-laden, demonstrating misunderstanding, incorrect knowledge, or confusion.
- 0 ZERO is a special category: while not indicative of quality, it is generally assigned to papers that are blank, illegible, or address a different topic.

Members of the staff of Alberta Education train the examiners (markers). In training sessions, examiners are given scoring guides and responses that exemplify each category. The reasons for classifying responses in particular categories are discussed; examiners' questions are answered; sample papers are scored and categorizations are discussed; and, if necessary, modifications are made to the guides. The training continues until examiners are familiar with the application of the scoring guides and the scoring is consistent.

To ensure further the quality and inter-rater reliability of scoring open-ended responses, quality-control checks and reliability reviews are conducted during the entire scoring procedure.